Marriage/Mod-Line

Arizona
Department of Fire, Building and Life Safety

Office of Manufactured Housing

Issues

Multi-sectional mobile homes, manufactured homes, and residential and commercial modular buildings can weigh many tons. Units must be adequately supported and fastened to each other. Improper centerline or sectional support; or fastening may result in the following failures:

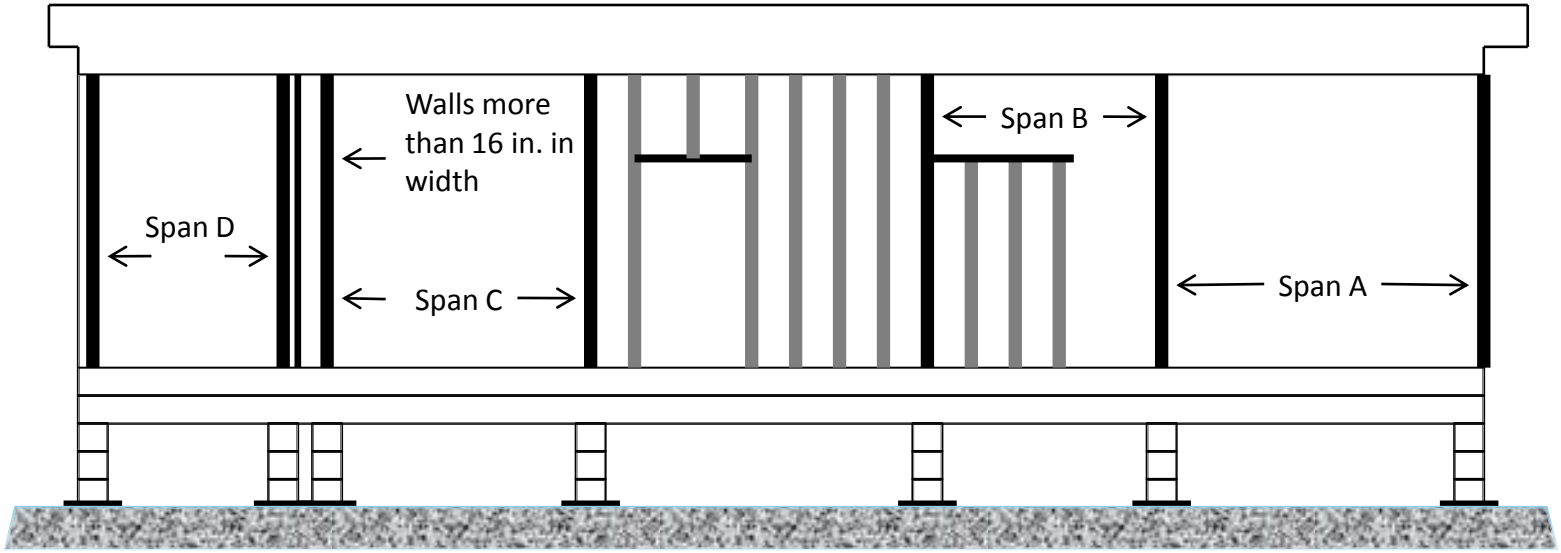
- **Ceiling cracks**
- **Crowning of floors**
- **Binding windows and doors**
- **Centerline roof sag**
- **Leaks**
- **Collapse**

Pier Location and Spacing

Location and spacing of piers is dependent upon dimension, live and dead loads, type of construction, soil bearing capacity, I-beam size, footings, doors, windows, columns, and interior open spans. Location and spacing requirements vary but are available in the following resources:

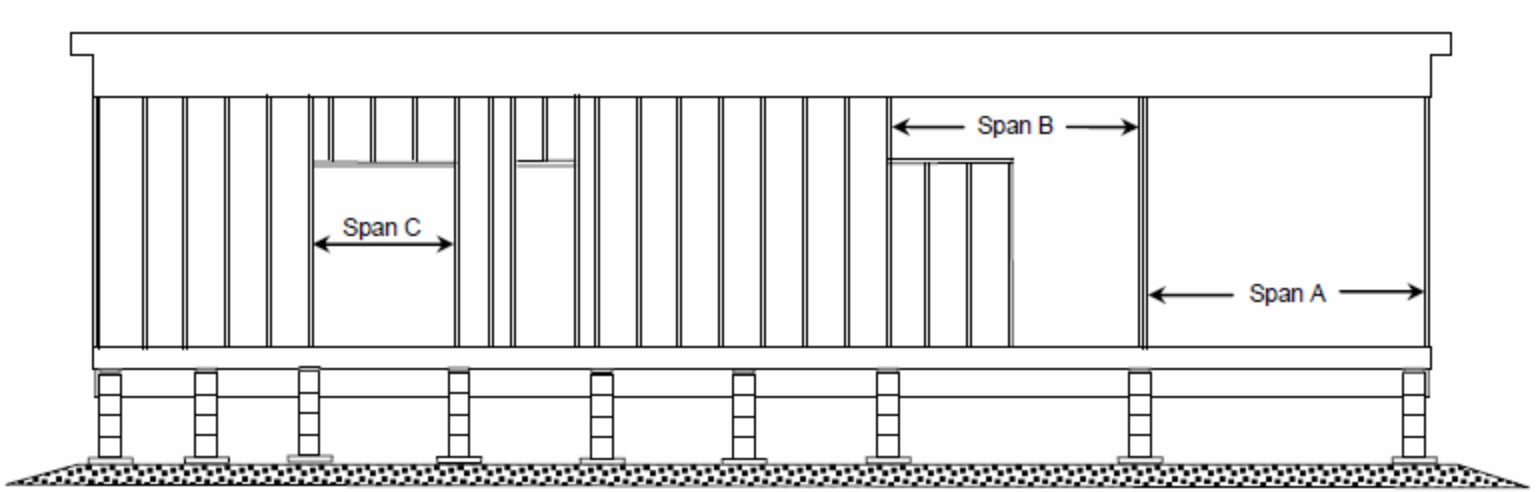
- **Manufacturer's Installation Instructions**
- **24 CFR part 3285 HUD's Installation Standards**
- **Arizona Approved design provided by a registered architect or engineer**

Column Pier Support when Frame Only Blocking is Required



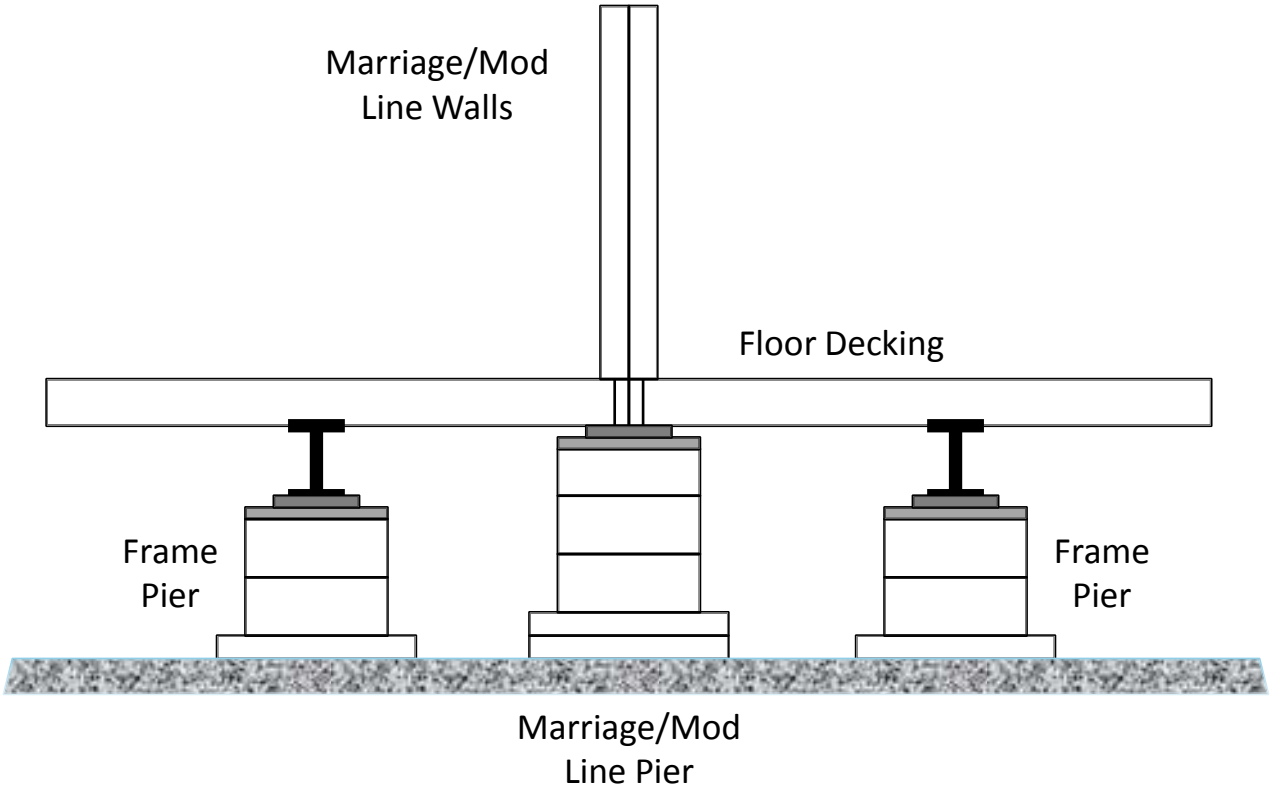
- **Both sides of open spans and doorways over 48 inches**
- **Additional piers with open spans over 10 feet**
- **Unsupported ridge-beams are included open span**
- **Column supports**

Column Pier Support when Perimeter Blocking is Required



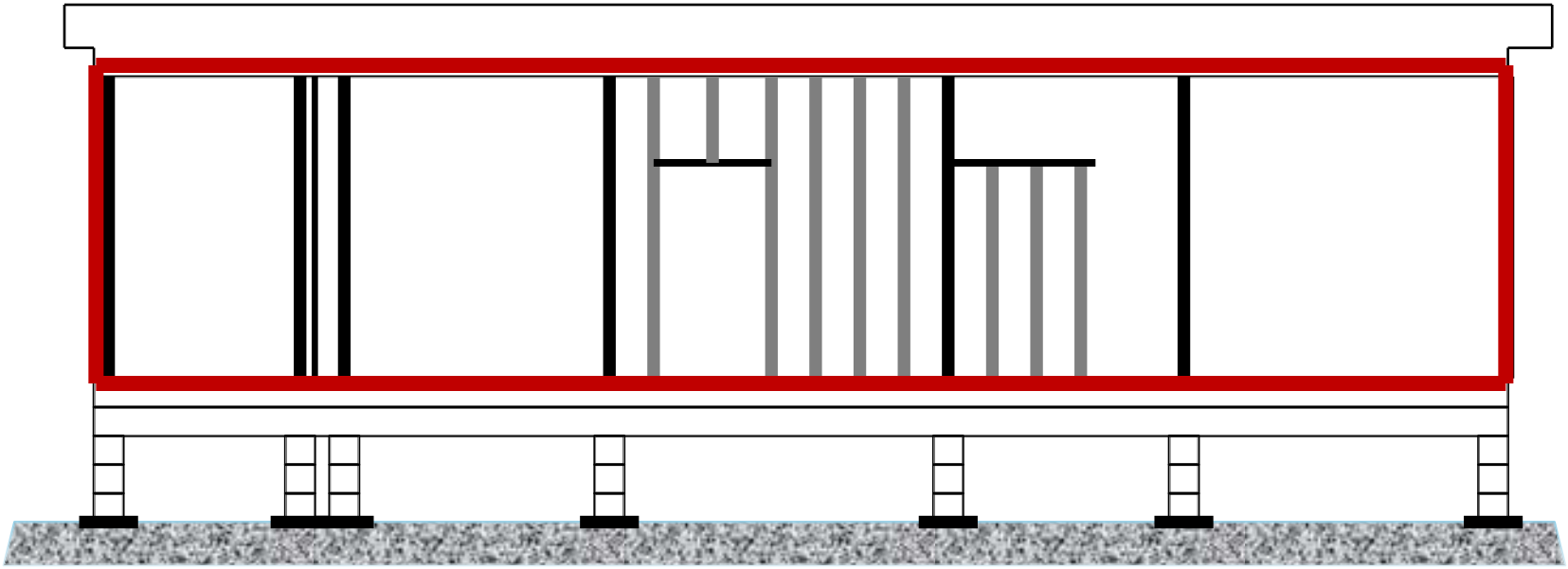
- Maximum pier spacing based on roof load
- Both sides of open spans and doorways over 48 inches
- Unsupported ridge-beams are included in open span
- Column supports

Marriage/Mod Line Piers



- **Perpendicular to rim joists**
- **Supports both floor sections**

Protection from Air Infiltration and Condensation



- Per manufacturer's installation instructions
  - Continuous non-porous gasket
  - Sill sealer
  - Foam sealant

Marriage/Mod-Line Fastening

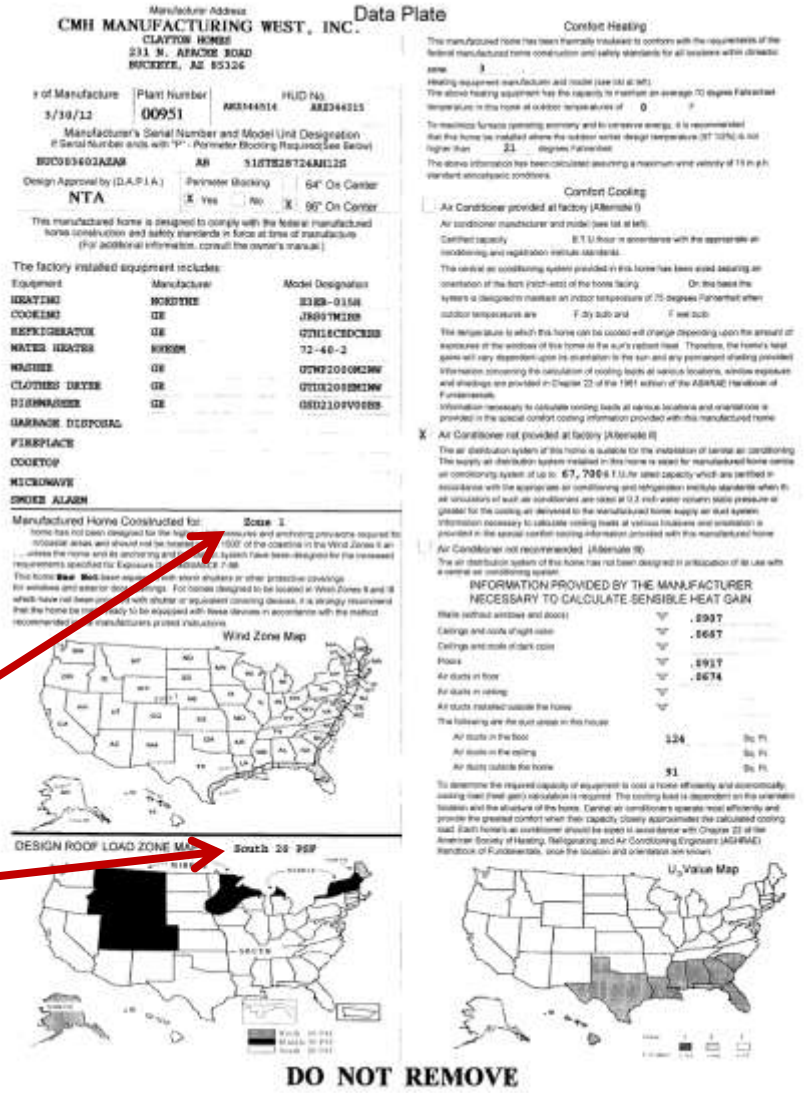
Proper fastening of the marriage/mod-line to the manufacturer's installation instructions , HUD Part 3285.802, or Arizona State Approved plan will prevent settling and structural issues. Not all units are the same, so fastening methods will vary. Factors that affect fastener sizes and methods:

- **Wind zone**
- **Roof load**
- **Hinged roof**
- **Multi-story**
- **Tag units**

Marriage Line Fastening

To determine fastening of the floors, interior walls, exterior walls, and roof; identify roof load and wind zone of unit on data plate in a manufactured home or FBB state approved plan.

Example: For a manufactured home, this data plate shows Wind Zone 1, with a 20 PSF roof load



Floor Fastening

Fastening schedule is per manufacturer's installation instructions or State approved plan. Manufacturer's installation instructions will vary and not all installation methods are appropriate for every unit.

Example: State approved plan from an FBB:

- **(Basement chassis) 3/8" or 1/2" bolt x 3" w/nut, and 2 washers through clips, 8' O.C. 3/8" x 5 1/2" lag each side at 4' O.C.**

- **(Perimeter chassis) 1/2" x 3" bolt with nut and 2 washers through clips, 8' O.C. (max) each side. All bolts A307 grade.**

Floor Fastening

Typical Schult manufactured home:

- **(2007 manual) 5/16” x 4” min. lag screw at 20” O.C. entire length, staggered at half spacing. That means a lag will be installed every 10”. The distance between lags reduces for wind zones 2 and 3. The distance between lags also reduces for triple-wides over 36’ in width. Gaps between floor joists also reduce lag spacing depending on the size of the gap.**

- **(2010 manual) 3/8” x 3 1/2”-6 1/2” lags screw at 24” O.C. entire length, staggered at half spacing. Metal straps required for wind zones 2 and 3.**

Floor Fastening

Typical Cavco manufactured home:

• (2008 manual) 3/8” x 4 1/2” min. lag screw at 96” O.C. entire length, staggered at half spacing. That means a lag will be installed every 48”. Metal straps are required for Wind zones 2 and 3 (Refer to Cavco Addendum). Pre-drill a 11/64” pilot hole for lags (required).

Floor Fastening Example

4 1/2” lags and washers sent with unit for floor fastening. Installed at less spacing between lags than required by manufacturer’s installation instructions, which is acceptable. Staggered lagging, as required.

Wall Fastening

Fastening schedule is per manufacturer's installation instructions or State approved plan.

Typical Schult manufactured home:

• (2010 manual) Endwalls – Two methods are available, both to be fastened behind sheathing. Exterior wall sheathing re-installed using 15GA x 7/16" x 1 1/2" staples or 6d nails spaced 2 1/2" O.C. to all horizontal and vertical framing members. Pre-drill holes for bolts, 3/8" x 7" or 1/2" x 7" bolts with washers on both side and nuts; or, use 3/8" x 6" lags. 12" from ceiling, 12" from floor, and center of stud from ceiling to floor.

Wall Fastening

Typical Schult manufactured home continued:

- **(2010 manual) Interior walls – Fill gaps with wood shims, gypsum, or sheathing. Secure with straps or long screws to prevent movement.**

- **(2010 manual) Tag units - #10 x 4” wood screws at 24” O.C. If pre-drilled holes are provided use 5/16” x 6” lags at 24” O.C.**

Wall Fastening

Typical Cavco manufactured home:

- **(2008 manual) Endwalls - #8 x 3” wood screws, 8” O.C. toe fasteners at 45 degree angle.**

- **(2008 manual) Marriage wall columns, openings and interior partitions - #8 x 4” wood screws, 16” O.C.**

- **(2008 manual) Tag units - #8 x 4” wood screws, 12” O.C.**

Wall Fastening Example

A 2012 Cavco home with interior wall gaps being shimmed wood before fastening, to prevent air and moisture infiltration and maintain structural integrity.

Wall Fastening Example

A 2012 Cavco home being fastened, to prevent air and moisture infiltration. Wood screws installed at 45 degree angle on one side due to doorway at marriage line. Acceptable per manufacturer's installation instructions.

Roof Fastening

Fastening schedule is per manufacturer's installation instructions or State approved plan.

Example: State approved plan from an FBB:

- **Plywood ridge beam – 3/8" x 4" (all thread) lags at 48" O.C. on alternate sides of beam (top and bottom). Optional 5/8" bolt with nut and 2 washers at 48" O.C. Bolts to be A307 minimum grade.**

- **Steel clearspan truss – 1/2" x 8 1/2" A307 bolts or all-thread rods with washers, 6' O.C. staggered truss top chord and bottom chord.**

Roof Fastening

Typical Schult manufactured home:

• (2010 manual) Multi-section ridge line, wind zone 1 – 1/2” bolt with 15/16” washers and nut in all pre-drilled holes in ridge beam. Single bolt holes will be pre-drilled by the manufacturer at intervals of 12” to 48” along beam. Some home configurations will require cluster bolts.

• (2010 manual) Wind zone 2 and 3 - 26GA x 1 1/2” strap 96” O.C. over truss wind zone 2. 26GA x 1 1/2” strap 80” O.C. over truss wind zone 2. Secure with (10) 15GA x 1 1/2” staples or (4) #10 x 1 1/2” screws each end of strap

Roof Fastening

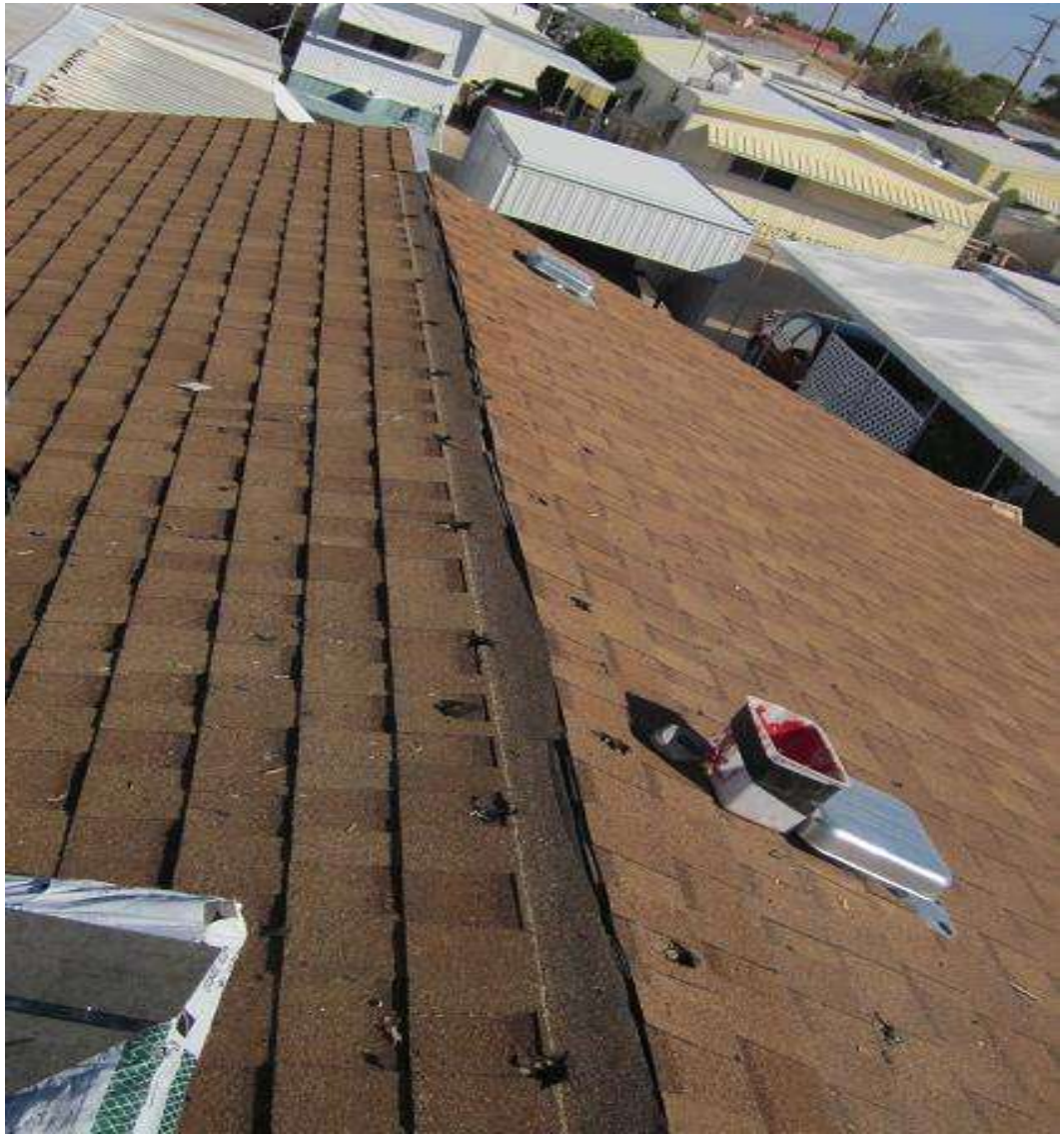
Typical Cavco manufactured home:

- **(2008 manual) Pre-drill hole through roof decking. Pre-drill 11/64” pilot holes for 3/8” x 6” lags with washers at a 45 degree angle. 24” O.C. for wind zone 1, 20 & 30 PSF roof loads, staggered half spacing. 48” O.C. for wind zone 1, >30 PSF roof loads, staggered half spacing. Fill open holes with putty or caulk to prevent shingles from sinking into holes over time.**

- **(2008 manual) See Cavco Addendum for wind zones 2 and 3.**

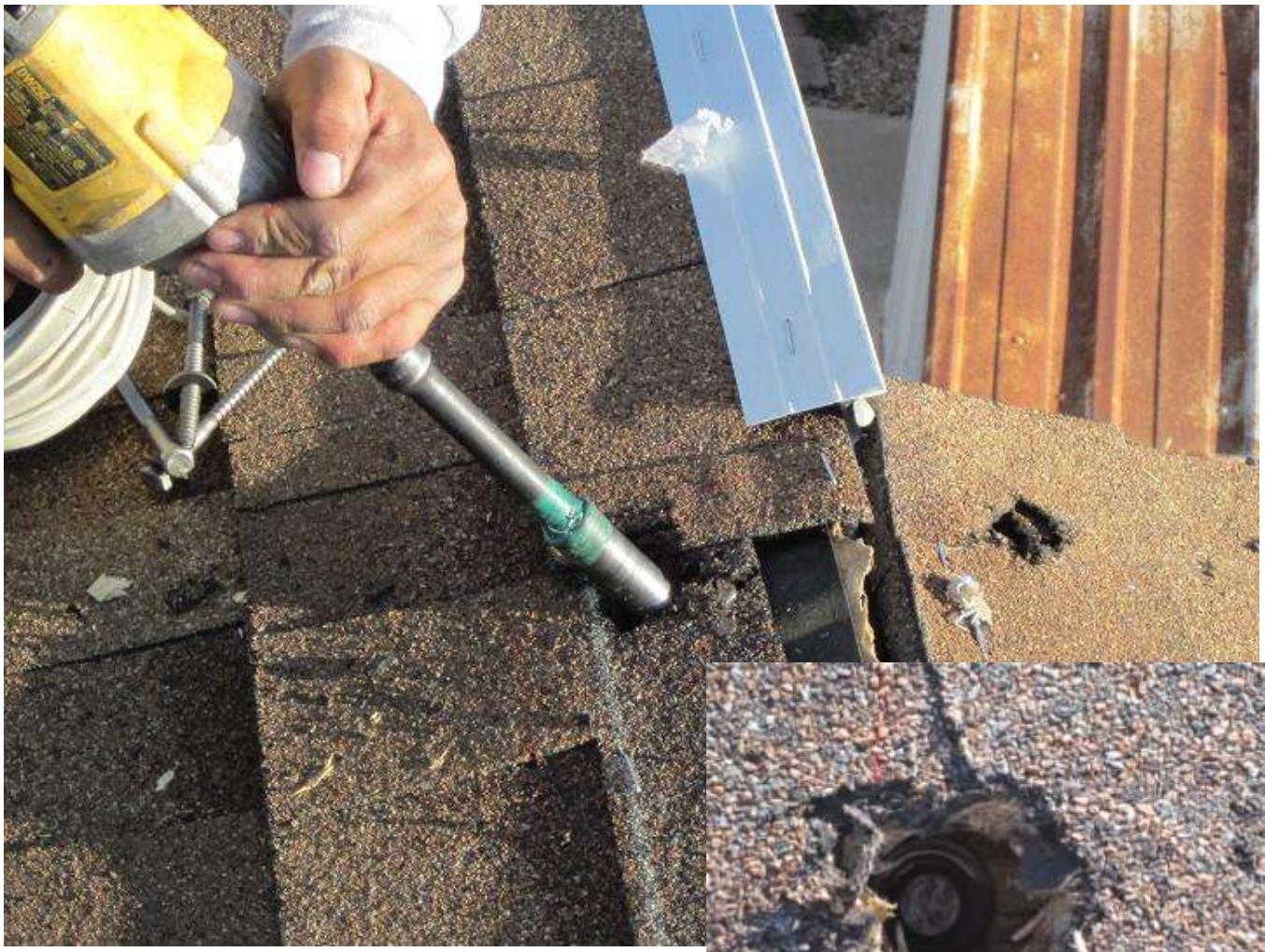
Roof Fastening Example

A 2012 Cavco home ready to be lagged. Holes are approximately every 24”, staggered half spacing.



Roof Fastening Example

A 2012 Cavco home being lagged at a 45 degree angle. Lag with washer required.



Roof Close-Up

Close up methods vary between manufacturers and FBB builders.

Typical Schult manufactured home:

• (2010 manual) Roof – Fasten sheathing with 8d nails at 6” O.C. along edged and 12” O.C. in the field. Install underlayment, 15# felt along length of ridge and overlapping sheathing joints by at least 5” on each side. Fasten with 1” x 1” x 16GA staples. Apply 6” wide of roofing cement for wind zones 2 and 3. Install shingles with 12GA x 1 1/4” long, 3/8” diameter head roof nail, or 16GA 1” crown x 1” length staples.

Roof Close-Up

Close up methods vary between manufacturers and FBB builders.

Typical Cavco manufactured home:

• (2008 manual) Roof – Install underlayment, 15# felt along length of ridge and overlapping sheathing joints by at least 5” on each side. Fasten with 1” x 1” x 16GA staples. Apply 6” wide of roofing cement for wind zones 2 and 3. Install shingles with 12GA x 1 1/4” long, 3/8” diameter head roof nail, or 16GA 1” crown x 1” length staples.

Roof Close-Up Example

Underlayment being installed as part of the close-up process.

Roof Colse-Up Example

Applying the ridge cap.

Flexible Duct Crossover

Flexible duct under floors and inside roof cavities should be listed for appropriate use and connected per manufacturer's installation instructions, to include:

- **Proper connection of inner duct to collars, V-box/trunk duct, or distribution boxes.**
- **Trim off slack, to avoid collapsed duct.**
- **Connections secured with ties, clamps, tape, etc.**
- **Seal all joints with UL listed tape or mastics.**

Bad Duct Crossover Examples (Common)

Below: Not supported correctly, touching soil.

Above: Not supported at all, excess duct, and sitting on soil.

Good Duct Crossover Example

Properly supported crossover duct. Duct is off soil, not pinched, and straps are wider than the space between the spiral rungs.

Floor Duct Crossover

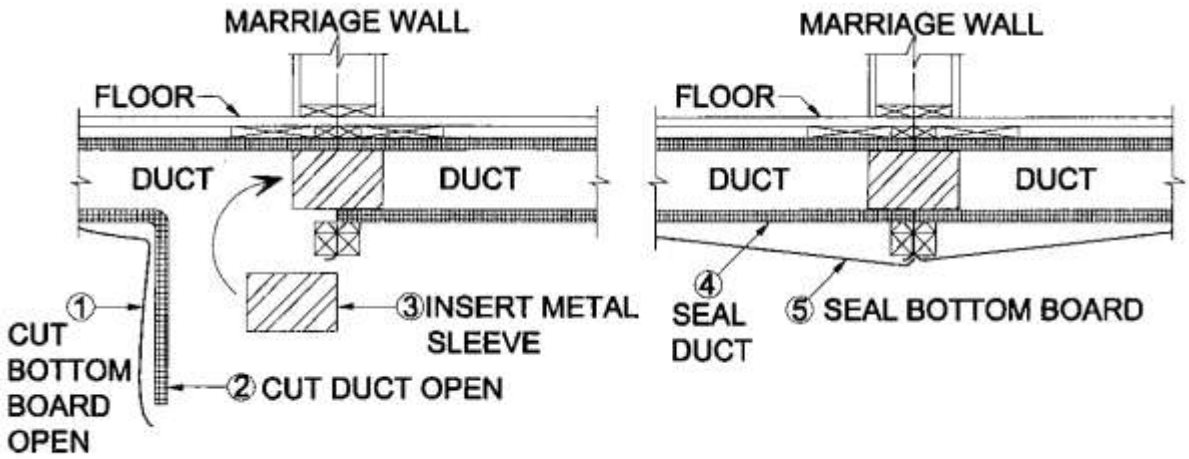
Some units have in floor ductwork requiring an alternate method of connection.

Typical Schult manufactured home:

- **(2010 manual) Through rim joist without sleeve:**
  - **Ensure gasket is in place and align halves of home to ensure crossover ducts align properly.**
  - **Seal duct connection**
  - **Pier support required below duct opening in rim joist, shim to support the duct and the rim joist.**

Floor Duct Crossover

- **(2010 manual) Duct board with sleeve:**
  - **Cut open bottom board and cut open duct at marriage line.**
  - **Insert metal sleeve.**
  - **Seal duct back in place.**
  - **Seal bottom board.**



Electrical Crossover

Electrical connections are per manufacturer's installation instructions with the home.

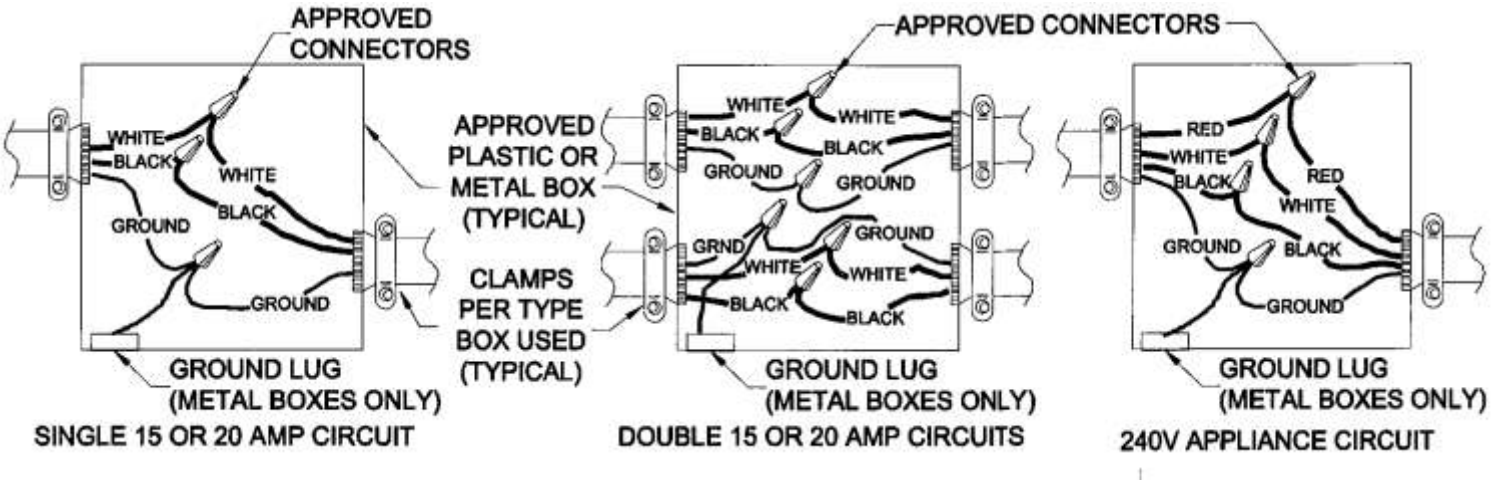
• (2010 manual) Snap connectors: Connect snap connectors according to the connector manufacturer's installation instructions.

• (2010 Schult and 2008 Cavco manuals) Joining wires: Pull circuit wires into junction box through a romex connector and secure snugly. Strip wires and connect with appropriately sized wire nuts. Connect ground to junction box and/or cover plate.

Electrical Crossover Example

Types of junction box connections:

- **2010 Schult manual**
- **2008 Cavco manual**

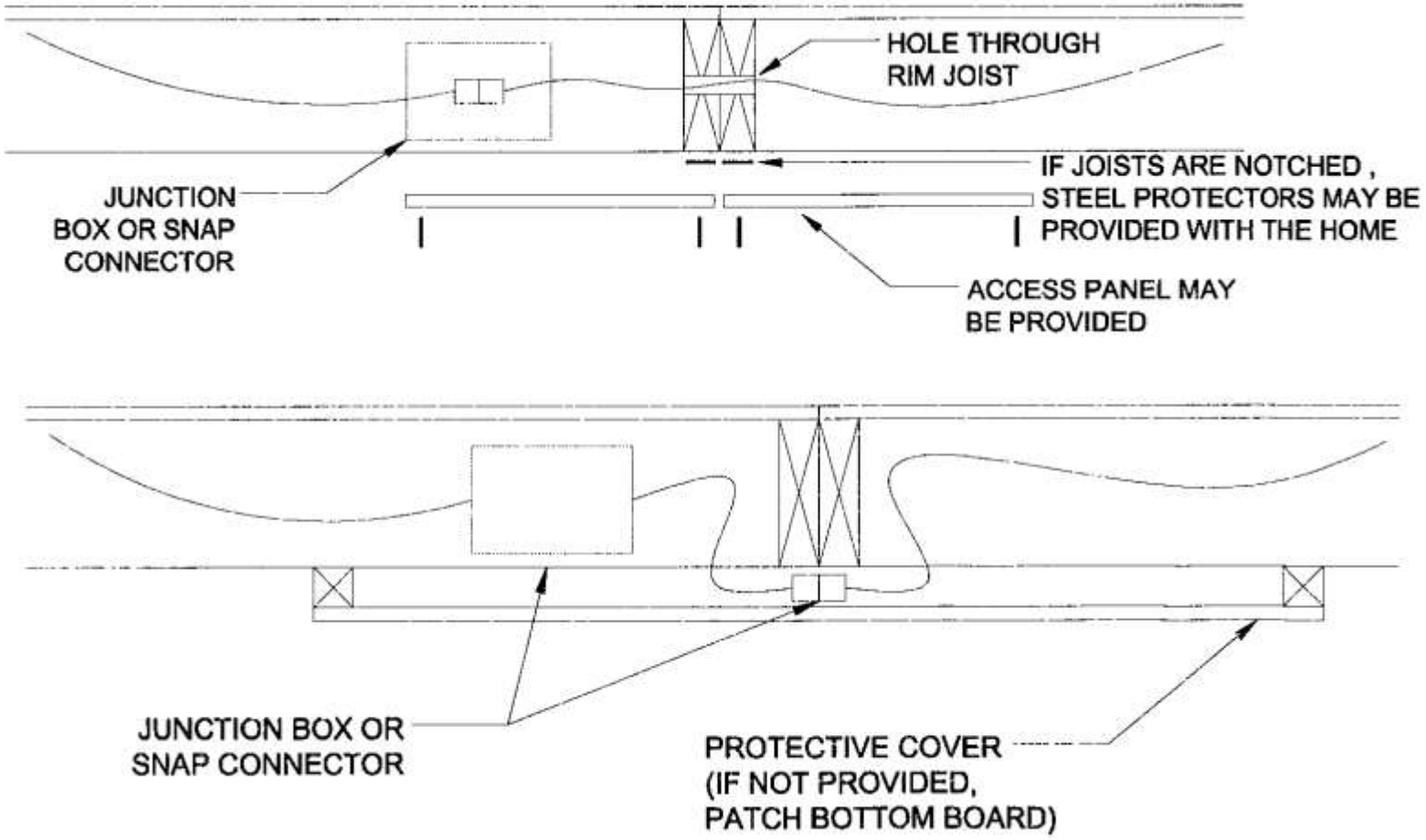


Floor Crossover

Electrical connections are per manufacturer's installation instructions with the home.

•(2010 Schult and 2008 Cavco manuals) Access panel: Pass wires through pre-drilled holes or notches in the rim joist or bumped out access panel. Connect wire via junction box or snap connectors and secure with staples to adjacent joists or studs within 8" of junction box or snap connectors. Install smash plates and seal bottom board.

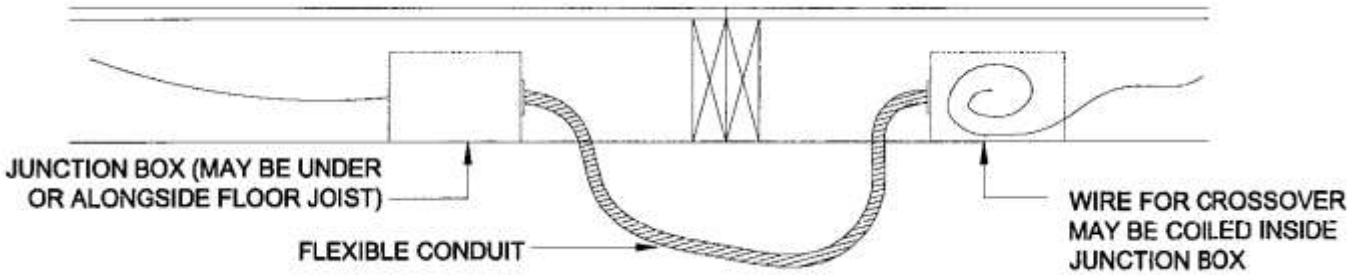
Floor Crossover Example



Floor Crossover

Electrical connections are per manufacturer's installation instructions with the home.

•(2010 Schult and 2008 Cavco manuals) Junction box with conduit: Remove access panels open bottom board and remove junction box covers. Run wires through flexible conduit and connect conduit to junction boxes. Connect wires in junction box with appropriate sized wire connectors. Replace and secure covers on junction boxes and seal floor.

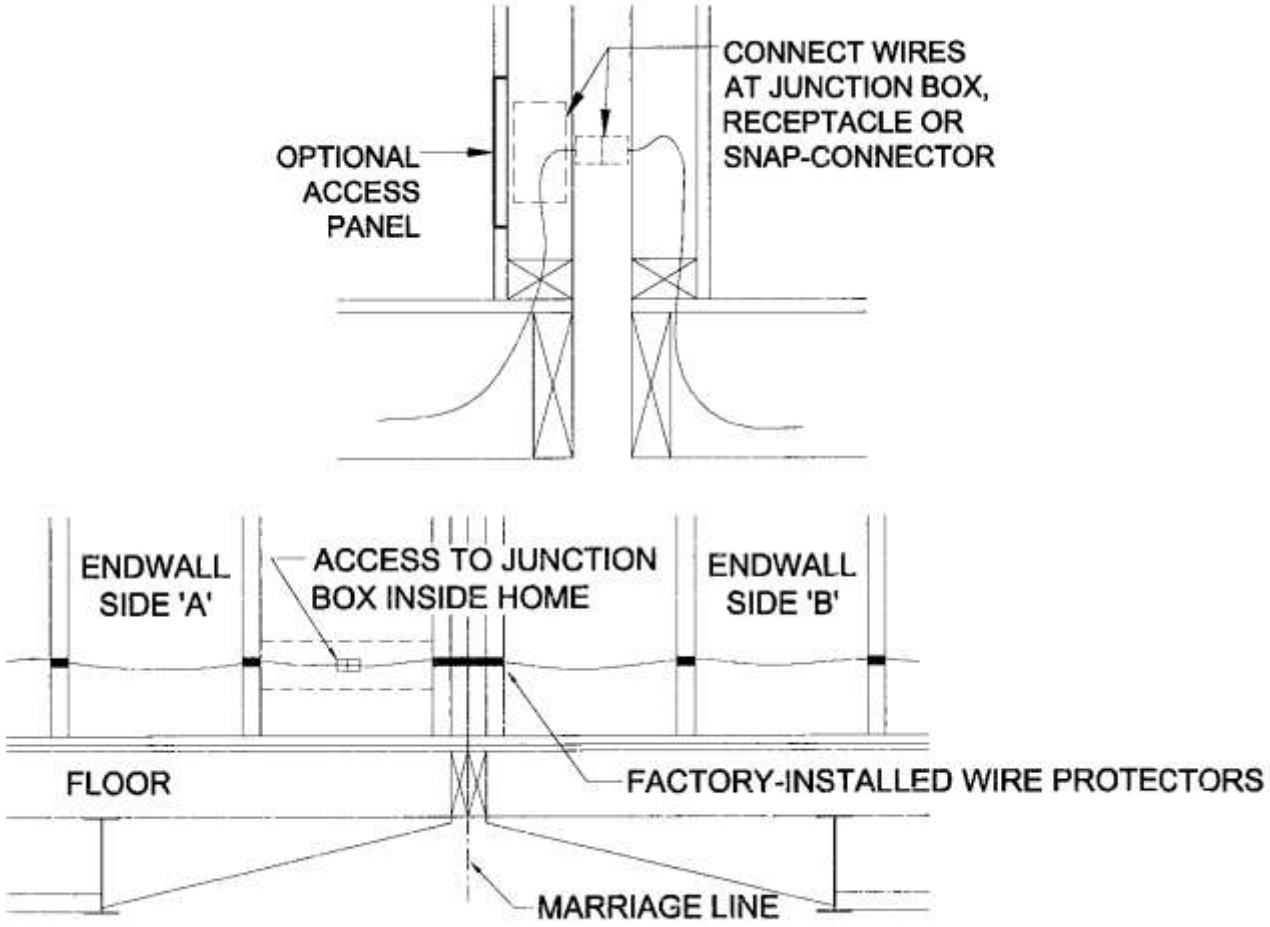


Wall Crossover

Electrical connections are per manufacturer's installation instructions with the home.

•(2010 Schult and 2008 Cavco manuals) Wall crossovers: Connect electrical, phone, cable television and stereo speaker wires prior to bringing sections together. Ensure wires are protected, to prevent damage during marriage/mod-line fastening or pinching between studs.

Wall Crossover Example



Bonding

Electrical connections are per manufacturer's installation instructions with the home.

- **(2010 Schult and 2008 Cavco manuals) Bonding wire: Uncoil and attach bonding wire (#8 minimum bare copper wire) to lug to each section of unit. Torque to manufacturer's requirements.**

- **(2010 Schult and 2008 Cavco manuals) Bonding strap: Attach 4" bonding strap to each pair of adjacent chassis with two #8 x 3/4" self-tapping metal screws (one screw each side).**

Water Lines

Water crossover connections are per manufacturer's installation instructions with the home.

Water lines shall be connected using flexible pipe or a rigid connector line and fittings. Primer and cement shall be applied to connections (if required) per manufacturer's installation instructions. All connections shall be tested for leaks prior to wrapping water lines or sealing the floor to prevent water lines from freezing.

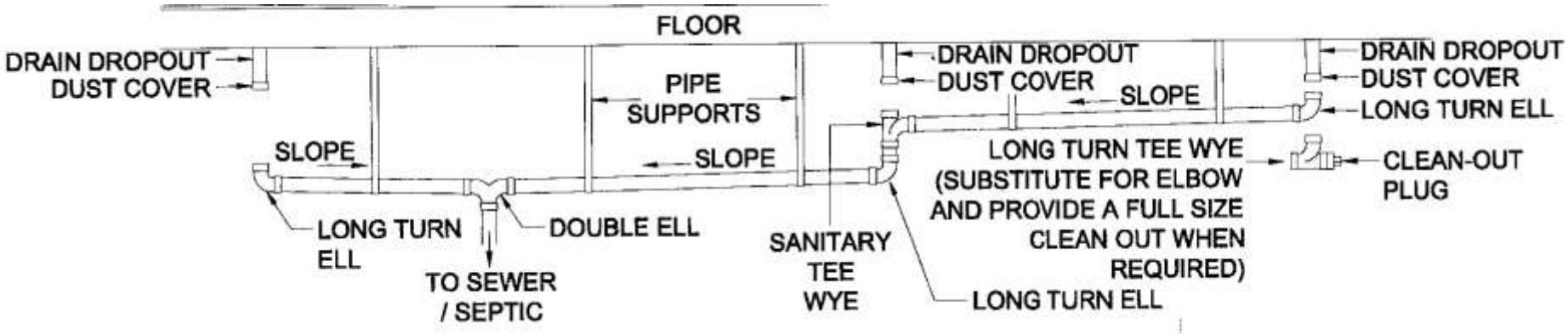
Drainage and Waste

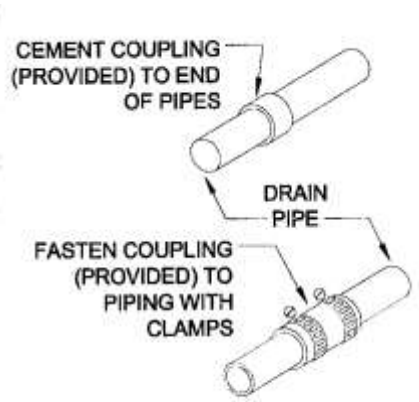
Drainage and waste crossover connections are per manufacturer's installation instructions with the home.

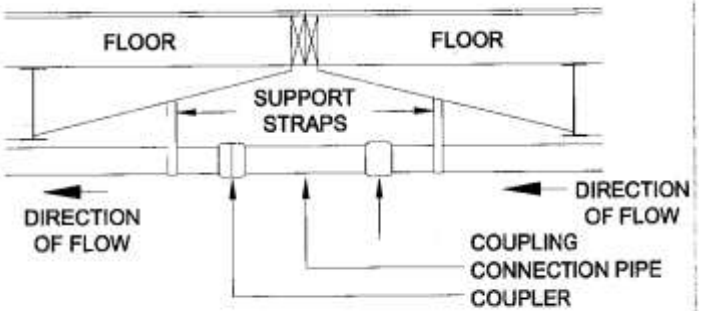
•(2010 Schult and 2008 Cavco manuals) Remove shipping covers, inspect pipes and fittings. Install sections, fittings and sweeps in direction of flow. Install clamps or apply cement as per manufacturer's installation instructions. Provide a minimum of 1/4" per foot slope towards sewer/septic. Install a full sized clean-out at the upper most point of the run and maintain 1/8" of slope per foot, if 1/4" slope cannot be maintained. Support drain with straps every 48" max. test for leaks and proper drainage.

Drainage and Waste Examples

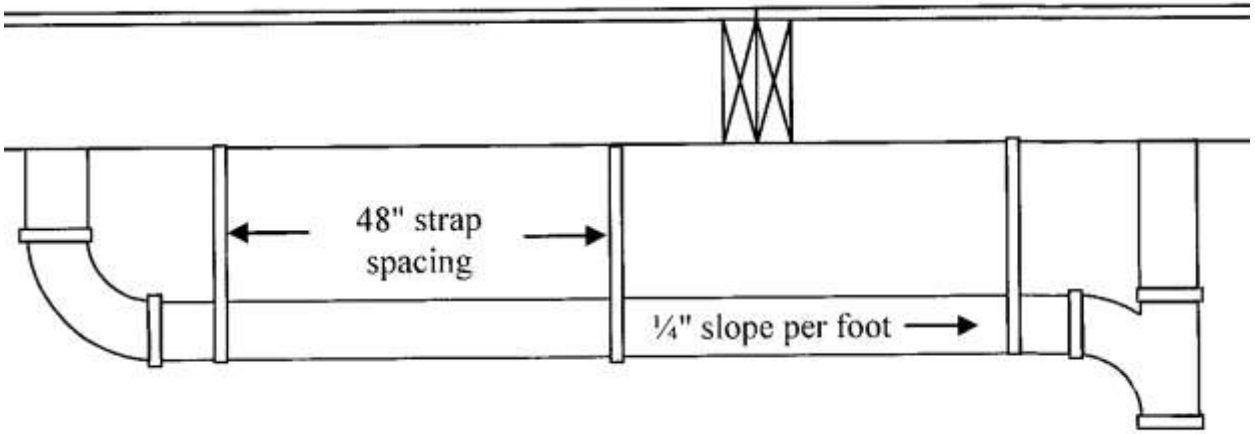
Typical DWV system and crossover connections.



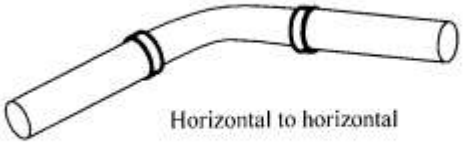




Drainage and Waste Examples



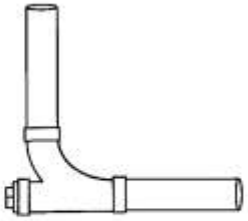
Left: Slope and support.

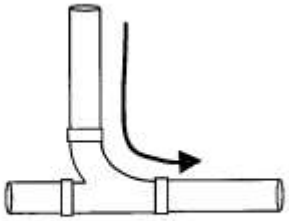

Horizontal to horizontal


Vertical to horizontal

Right: Fittings and direction of flow.


Sanitary tees must always be used in the vertical position.

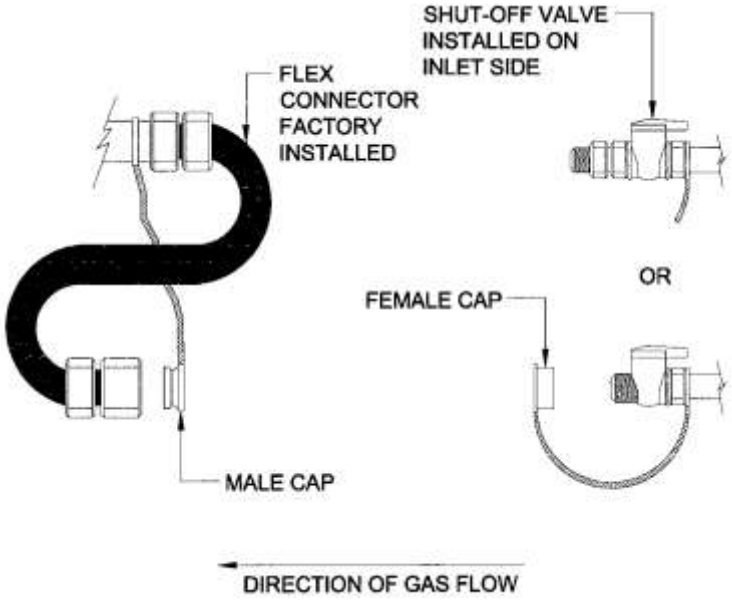

Vertical to horizontal with cleanout


Sweep in the direction of flow

Gas Crossover

Gascrossover connections are per manufacturer's installation instructions with the home.

•(2010 Schult and 2008 Cavco manuals) Gas crossover connection may use quick disconnect fittings or threaded connectors. Connect crossover sections. Inspect and test pipes, fittings and valves for leaks prior to connection to gas source.



Exterior/Interior Close-Up

Close up methods vary between manufacturers and FBB builders. Most manufacturers have similar methods, but vary depending on the type of siding: panel, lap, vinyl lap, or stucco.

- **Install panel siding or lap siding per manufacturer's installation instructions.**
- **Complete wall and ceiling finishes.**
- **Install trim.**
- **Caulk and paint.**
- **Complete carpet.**

Questions?

Department of Fire, Building and Life Safety

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